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How to Prepare for and Write a Grant: Personal Perspectives

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Success in academic medicine is driven in large part by obtaining grant funding. Resources are limited even in the best of circumstances; therefore, competition is frequently fierce. Herein we outline our personal perspectives[1] gained over decades of (painful) apprenticeship and mentoring as well as planning, writing, rewriting and reviewing grants. We focus on independent investigator-initiated (ie, R01, VA Merit Awards) applications, although many of the concepts are applicable to mentored or similar career development award applications and summarized in recent publications.[2–6]

Timing of Grant Submission

Among the pressing questions are: When is the best time to write a grant and what steps optimize the likelihood of a successful outcome? The answers depend on your career stage (eg, fellow vs faculty), the type of grant you envision (eg, career development type [K-series] vs independent investigator type [R-series]) and (a major determinant) how much preliminary including published data you already have. For clinical and epidemiologic grants, the availability of or access to relevant, well-characterized patient cohorts or biological samples is key. In the context of applying for your first (ie, A0 application) independent (R01 or equivalent) award, a key consideration is the timing of the submission in relation to publications. Ideally, a new independent grant submission will be based on a foundation of ≥1 or 2 recent (within 18 months) publications, substantiating the proposal and reflecting your role as first or corresponding author. Reviewers will understand if those publications have your mentor as a coauthor (ideally not corresponding) and their inclusion (as coauthor) should not jeopardize your application.

Other Resources Needed to Accomplish the Proposed Study

Verify resource and time allocation (division/department head letters of support and institutional commitment) and collaborative arrangements for key resources. Finally, assign sufficient time to review, refine, and integrate the hypotheses and aims with input from colleagues and senior mentors to provide feedback. Of note, some institutions arrange formal internal reviews, or offer to pay external reviewers to critique grants before submission and are worth considering.

Key Points

- Plan initial (A0) submission in relation to recent high-impact publication(s).
- Do not waste a review round with premature application; it is difficult to go from unscored to a fundable score on A1 application.
- Allocate ≥6 months to preparation of a new (A0) R01 application to optimize organization of aims as well as editing and rewriting. Find examples of previously funded grants.
- Life is short; invest your time in projects you like and want to do, and then apply for grants to accomplish these projects rather than pursuing projects that simply follow the money trail.
- Assemble a team that includes individuals who you think will actually help with the content, methods, and editing. Discuss with, and if appropriate include as coinvestigator, mentor or senior colleagues early on. Draft letters of support for all investigators on the team. Do not wait until the entire proposal is written before you engage the research team.
- Plan to review all biosketches and personal statements and make sure they are updated, well-formatted, and fit the purpose of the specific grant.

Preparation and Anticipation

Is the Grant Mechanism Appropriate for the Proposed Study?

Most grant applications are written in response to an announcement or statement of interest from the funding

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agencies. Are your ideas responsive to the needs of the funding agency? We recommend early contact with the program officer to ensure that there is general interest in your idea. Verify the required resources will be adequately covered with the allowed budget and duration of the awards.

Engage Statistical Help Early

For clinical grants in particular, both feasibility and resources are highly correlated with anticipated recruitment and duration of follow-up, if any; therefore, we recommend at least a "back of the envelope" power and sample size calculation and project budget early on in the planning process.

Updated Grant Requirements

Even experienced investigators need to read and review updated grant requirements (publication NOT-OD-16-011 discusses in detail both application instructions and review language that have been updated for the National Institutes of Health [NIH] applications). These instructions and requirements frequently change.

Tell a Story and Anticipate Questions

The purpose of writing a grant is to tell a story in which you influence, excite, and convince the reviewers and funding agencies. Try to anticipate the questions that reviewers will ask and frame your entire application to reflect these expectations. Reviewers will ask 5 distinct general questions.

Hypothesis. Reviewers (very much) like hypothesis-driven research. Is there a clearly stated, central hypothesis? Is the central hypothesis interesting, novel, and timely? In other words, will the outcome really advance knowledge and exert a sustained impact in the field? Is the hypothesis embedded throughout the application? Descriptive or observational studies usually do not fare well.

Feasibility. Reviewers will scrutinize applications from junior faculty submitting an independent award to answer whether you can actually do what you propose. They will ask if you are using state-of-the-art approaches. They will expect you to justify that you have the technical expertise and institutional resources to undertake new and untested approaches. They will ask if the experiments you propose can be accomplished with the reagents (eg, animals or cell lines) in hand. If key reagents are not in hand or, for example, if the phenotype of knockout mice is yet to be verified, reviewers will expect you to justify contingencies. For clinical and epidemiologic research proposals, verify access to the populations and patient material you propose and provide contingencies for patient accrual. Reviewers for these types of grants will ask if the proposed studies are feasible within the timeframe proposed. They will evaluate the sample size and power calculation sections closely. Perceived low-power or small sample sizes are usually fatal flaws that reliably lead to a poor score.

Investigator and Environment. The key metrics include the applicant's past performance (background, training, earlier publications) and overall (but especially) recent productivity, namely, those publications underpinning current proposal. Reviewers will ask if successfully accomplished, will those studies build on an independent trajectory? In addition, and particularly for faculty proposing a new independent application, it is crucial to demonstrate strong mentorship as an ongoing (environmental) resource in troubleshooting.

Impact. Reviewers will ask if addressing the aims as outlined will exert a sustained impact and influence the field. Does the proposal challenge an existing paradigm? Will the findings advance knowledge of the pathogenesis, treatment or prevention of disease? Solicit input from senior colleague or mentor to align the goals and aims of the application to emphasize impact.

Significance. Your proposal must address why the questions are important, how the answers address an unmet need and their relevance to disease prevention, pathogenesis, treatment, or outcomes (also, see Scientific Premise).

New Sections (2016). It is critical to include a formal section on rigor and transparency (ref NOT-OD-16-011). In addition include a sentence (or few) addressing the scientific premise, summarizing the background, preliminary data, and how your proposal addresses weaknesses or gaps in the field as outlined in the background and preliminary data. This item is now included as part of significance criterion for peer review. Rigor and transparency relates to the strategies to ensure a robust and unbiased approach and will influence overall impact score. Similarly, consideration of relevant biological variables (age, sex) is a key component for all studies including vertebrate animals or human subjects whose inclusion will influence overall impact score.

Key Points

- The scored review criteria are significance, investigator, innovation, approach and environment.
- Demonstrating your hypotheses, and addressing the feasibility and impact, are key determinants of scores related to significance, innovation, and approach.
- Know what the reviewers expect (and score you on) and make sure that you cover all of these points in the grant application.

Approach

We highlight some key issues pertaining to specific aims, background and significance, preliminary data, and research plan sections of the proposal.

Construct a Thumbnail Outline

Opening statement should summarize the background that informs objectives and justify a central, overarching hypothesis. Use the active voice, ("Because of XXX, we will examine YYY…). Consider a summary figure in which the aims are integrated into the relevant pathways and